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Newport
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PRIORITY DOCUMENT

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I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

I also certify that the attached copy of the request for grant of a Patent (Form 1/77) bears an amendment, effected by this office, following a request by the applicant and agreed to by the Comptroller-General.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

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Signed Stephen Hordley

Dated 23 September 2003

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Patents Form 1/77

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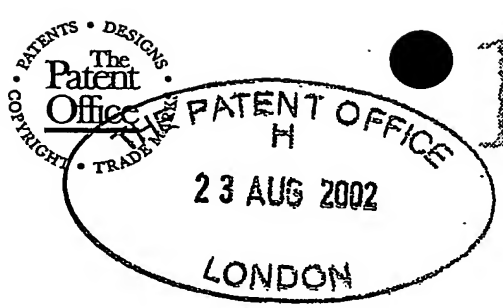
(Rule 16)



1/77

Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

The Patent Office

Cardiff Road
Newport
South Wales
NP10 8QQ

1. Your reference

M02B149/RJB

24AUG02 E743482-1 D02805
P01/7700 0.00-0219735.8

2. Patent application number
(The Patent Office will fill in this part)

0219735.8

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

The BOC Group plc, Chertsey Road, Windlesham, Surrey, GU20 6HJ

Patents ADP number *(if you know it)*

884627002

If the applicant is a corporate body, give the country/state of its incorporation

England

4. Title of the invention

Utilisation of Waste Gas Streams

5. Name of your agent *(if you have one)*

~~Roger James Bousfield~~

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

~~The BOC Group plc, Chertsey Road, Windlesham, Surrey, GU20 6HJ~~

Abel & Imray
20 Red Lion Street
LONDON
WC1R 4PQ
174001
Fs1/77 19/9/03
ES

Patents ADP number *(if you know it)*

~~973131002~~

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*

a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.
See note (d))

Yes

Pater

Patents Form 1/77

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form	0
Description	23
Claim(s)	1
Abstract	0
Drawing(s)	0

10. If you are also filing any of the following, state how many against each item.

Priority documents	0
Translations of priority documents	0
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	0
Request for preliminary examination and search *(Patents Form 9/77)*	1
Request for substantive examination *(Patents Form 10/77)*	0
Any other documents *(please specify)*	0

11. I/We request the grant of a patent on the basis of this application.

Signature [signature] Date 22 August 2002

12. Name and daytime telephone number of person to contact in the United Kingdom

Roger Bousfield
(01276) 807612

Warning

After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

Notes

a) *If you need help to fill in this form or you have any questions, please contact the Patent Office on 08459 500505.*

b) *Write your answers in capital letters using black ink or you may type them.*

c) *If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.*

d) *If you have answered 'Yes' Patents Form 7/77 will need to be filed.*

e) *Once you have filled in the form you must remember to sign and date it.*

f) *For details of the fee and ways to pay please contact the Patent Office.*

M02B149/RJB

UTILISATION OF WASTE GAS STREAMS

This invention relates to new methods of treating waste gas streams and, more particularly to one in which hydrogen present in such waste gas streams is purified for re-use.

Hydrogen gas is increasingly employed in the processing of silicon semi conductor and compound semi conductor devices including the manufacture of light emitting diodes (LEDs). The hydrogen gas tends to be purified in situ on the processing site immediately before use by passing it through a palladium diffuser body which separates impurities from the gas. However, due to the extreme flammability there is an increasing demand to treat the gas as an alternative to discharging it a roof top level.

Ammonia is also a major constituent of many semi conductor processes and is often used concurrently with, or sequenced with, hydrogen. Ammonia is a pungent gas with a TLV of 25ppm. However, when burned, great care is needed to prevent the formation of NO_x , whilst known wet scrubbing processes may well eventually de-gas the ammonia and/or result in high nitrate discharge rates in to ground water.

It is known that a hot, packed bed containing a suitable catalyst can decompose ammonia in to its constituents gas, nitrogen and hydrogen, to produce one part nitrogen and three parts hydrogen (by volume). This is an endothermic process and the gases and the catalyst need to be heated in accordance with the disclosure of our British Patent Application No. 2 353 034 A. Other ingredients can be added to the hot bed to remove other gases or vapours which may co-discharge from the reactor.

It is also known that simply burning hydrogen is a common alternative to high level atmospheric discharge. However, specific issues arise, in particular that standard burners need to possess adequate air added at all times to ensure complete combustion; in addition, large quantities of heat are generated which need to be managed through considerable additional engineering of plant and increased costs. Furthermore, concerns about "flashback" of hydrogen and oxidant mixtures also need to be managed.

There is therefore a need to provide a more effective way of managing hydrogen gas in terms of its recovery and/or the recovery of a good proportion of the latent energy of the hydrogen.

There is also a need to treat ammonia so that it is decomposed in to hydrogen (and nitrogen) before the hydrogen from that source can also be managed.

In accordance with the invention, there is provided a method of treating a hydrogen containing waste gas stream comprising passing the stream through a pressure swing adsorption system containing a suitable adsorption material (adsorbent) in order to separate the hydrogen from the waste stream and enable its recovery therefrom.

Preferably, the hydrogen produced from the pressure swing adsorption system using known adsorbents can be in excess of 99%, often in excess of 99.9% pure. Hydrogen of this purity can be passed through a palladium purifier to produce hydrogen gas of required purity of, or in excess of, 99.999%.

In embodiments in which ammonia is also present in the gas stream, the ammonia can be decomposed in to hydrogen and nitrogen prior to the purification step. Preferably the decomposition is effected by means of a hot catalyst.

The pressure swing adsorbents will generally be effective in separating the hydrogen from nitrogen in particular. They are therefore effective in separating hydrogen gas itself from a gas mixture or in separating the hydrogen gas constituent of ammonia (including any hydrogen gas itself which is present) from the gas mixture.

Hydrogen gas recovered in this way may be reused/reintroduced in to the semi conductor processing tool after final purification in a palladium purifier.

CLAIMS

1. A method of treating a hydrogen containing waste gas stream comprising passing the stream through a pressure swing adsorption system containing a suitable adsorption material (adsorbent) in order to separate the hydrogen from the waste stream and enable its recovery therefrom.